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17 March 2008

Mr. Ryan Seelbach
Presidio Trust
34 Graham Street
Post Office Box 29052
San Francisco, California 94129-0052

Subject: Building 1040 Indoor Air and Cap Assessment Work Plan for the Building 1065 Area Corrective Action Implementation Work Plan
Presidio Trust, San Francisco, California
(EKI A70004.19)

Dear Mr. Seelbach:

Erler & Kalinowski, Inc. ("EKI") is pleased to present this Building 1040 Indoor Air and Cap Assessment Work Plan as an appendix to the *Corrective Action Implementation Work Plan, Building 1065 Area, Presidio of San Francisco, California*, dated 18 May 2007, prepared by MACTEC. This Work Plan has been revised to address feedback and comments from our meetings with representatives of the Regional Water Quality Control Board, San Francisco Bay Region ("Water Board") on 14 November 2007 and on 30 January 2008. Although the National Park Service ("NPS") could not attend the November meeting, they were supplied with a copy of the meeting minutes. This Work Plan addresses the assessment of potential vapor intrusion to indoor air, assessment of the building slab which is serving as a cap to limit potential exposure to residual petroleum hydrocarbons beneath the building, and review of needs for potential improvements to the cap.

If you have any questions please do not hesitate to call.

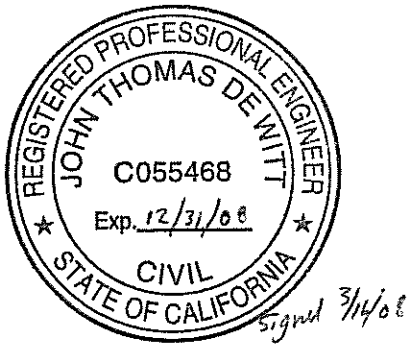
Very truly yours,

ERLER & KALINOWSKI, INC.

for

Michelle King, Ph.D.
Vice President

John DeWitt, P.E.
Project Manager



BUILDING 1040 INDOOR AIR AND CAP ASSESSMENT WORK PLAN

An Appendix to the
Corrective Action Implementation Work Plan, Building 1065 Area
Presidio of San Francisco, California

Prepared for:

Presidio Trust
San Francisco, California
(EKI A70004.19)

13 March 2008

BUILDING 1040 INDOOR AIR AND CAP ASSESSMENT WORK PLAN

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1.0 INTRODUCTION

On behalf of the Presidio Trust ("Trust"), Erler & Kalinowski, Inc. ("EKI") has prepared this Building 1040 Indoor Air and Cap Assessment Work Plan as an appendix to the *Corrective Action Implementation Work Plan, Building 1065 Area, Presidio of California*, ("Implementation Work Plan") dated 10 August 2007 prepared by MACTEC (MACTEC, 2007a). Building 1040 ("Site") is located in the northeast corner of the Presidio, in the Letterman Complex Planning District within Area B of the Presidio, between Thornburg and Eddie Roads (see Figure 1). Building 1040 is within an area being addressed by the Trust in the Building 1065 Corrective Action Plan ("CAP") (MACTEC, 2007b). The approved corrective action in the CAP for the petroleum-hydrocarbon impacted soil near Building 1040 (Soil Remedial Unit C or "RU-C") is capping and adoption of a land use control. As described in the CAP, the northwestern portion of the existing Building 1040 and the paved area outside of Building 1040 will serve as the cap to limit potential exposure to residual petroleum hydrocarbons under and near Building 1040.

This Work Plan includes an assessment of the potential for vapor intrusion into indoor air within Building 1040, assessment of the indoor portion of the cap, and review of needs for potential improvements to the indoor portion of the cap. The cap inspection activities for the area outside Building 1040 are identified in the Implementation Work Plan, and thus are not include in this Appendix to the Work Plan. To assess potential chemicals which may be present in indoor air due to vapor intrusion from the subsurface, soil gas samples are proposed to be collected and analyzed from six locations outside the building perimeter. Soil gas samples from outside the perimeter are proposed because access to the subslab vapor is restricted by the concrete thickness and equipment within the building. The results of soil gas sampling will be compared to applicable published screening criteria (or Site-specific values) for chemicals of concern in soil gas and potential risks due to vapor intrusion into indoor air will be evaluated.

EKI has prepared this Work Plan to implement the vapor intrusion and cap assessment at Building 1040 in accordance with the Building 1065 CAP and CAP Implementation Work Plan.[1] The approach of this Building 1040 Work Plan was developed taking into account the California Environmental Protection Agency, Department of Toxic Substances Control ("DTSC") guidance entitled *Interim Final Guidance for the Evaluation and Mitigation of Subsurface Vapor Intrusion to Indoor Air* (DTSC, 2004), U.S. Environmental Protection Agency ("U.S. EPA") guidance entitled *OSWER Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils (Subsurface Vapor Intrusion Guidance)* (U.S. EPA, 2002), and consultation with the Trust, the National Park Service ("NPS"), Regional Water Quality Control

[1] The CAP calls for indoor air monitoring. However, the Water Board has indicated that, given the Site conditions, it would be more appropriate to assess potential vapor intrusion risks at the Site using soil gas data. Indoor air monitoring is not a component of this assessment, but it could be a follow-up activity if soil gas data indicate potentially significant risks to future building occupants. In consultation with the Water Board and other stakeholders, the Trust is initially planning to assess potential vapor intrusion risks through soil gas sampling in order to address the CAP requirement for indoor air sampling.

Board, San Francisco Bay Region ("Water Board"), and DTSC. The Work Plan incorporates site visits to Building 1040 with Trust representatives where potential sample locations were selected and marked. This Work Plan will be provided to the NPS, Water Board, DTSC, and members of the Restoration Advisory Board ("RAB"). Collectively, these parties are referred to as the "stakeholders." The scope of work will be conducted in accordance with the Presidio-wide Quality Assurance Project Plan ("QAPP") (Tetra Tech, 2001).

2.0 BACKGROUND

Detailed site background and remedial approach for the Building 1065 Area is provided in the Building 1065 CAP (MACTEC, 2007b) and the Implementation Work Plan (MACTEC, 2007a). According to the Building 1065 CAP, Building 1040 was constructed in 1920 and formerly operated as a power house and steam plant. Two former aboveground storage tanks ("ASTs") (AST 1040.1 and 1040.2) provided fuel for the equipment. These tanks were refilled by the Army's fuel distribution system ("FDS"), a network of fuel supply lines at the Presidio. The tanks were located in the northwest corner of the building. The Army removed the tanks and the FDS pipelines in 1996. The building itself is considered a historic structure with contributive value to the National Historic Landmark and is therefore planned to be preserved.

The Building 1065 CAP identifies a limited area of petroleum hydrocarbon impacted soil in the northwestern corner of Building 1040 that is identified as RU-C. Former AST 1040.2 (a 20,000 gallon tank) was removed from this area. Residual concentrations of total petroleum hydrocarbons ("TPH") as fuel oil and unknown diesel hydrocarbons exceed applicable cleanup levels in soil. Maximum detected concentrations of TPH fuel oil and unknown diesel hydrocarbons in soil in RU-C were 290 mg/kg and 2,000 mg/kg, respectively. Benzene was detected slightly below the 0.005 mg/kg reporting limit, and acetone was also detected at a maximum concentration of 0.1 mg/kg. No other volatile organic compounds ("VOCs") were detected in the soil samples. Anthracene, benzo(a)pyrene, chrysene, fluoranthene, phenanthrene, and pyrene were detected in the soil samples. The maximum concentration of any detected polycyclic aromatic hydrocarbon ("PAH") was 0.096 mg/kg. No other PAHs were detected in the soil samples. No groundwater impact is noted in the RU-C Area. Limited access, chemical impacts five feet below ground surface, and the planned land use make capping an appropriate remedial alternative. The approved remedial action for the RU-C area is to maintain and monitor the existing cap and impose a land use control.

The mechanical equipment within Building 1040 remains in place. The building does not appear to have been cleaned out since the power house operations ceased, and the interior shows the accumulation of dust and dirt, combined with the oils and grease spills of a mechanical operations area. The presence of this equipment and the slab thickness to support the boiler equipment (measured as approximately 4 feet thick in some areas) limit the ability to collect sub-slab vapor samples from within the building footprint. EKI's review of available building drawings and site walk through confirms the difficulty in collecting subslab samples. Therefore, EKI proposes perimeter soil gas sampling to identify potential chemicals in the subsurface at Building 1040 that could volatilize into indoor air. The scope of this investigation also includes inspecting the building slab for functionality as a cap and identifying potential improvements for cap integrity.

The Trust is planning to lease Building 1040 to tenants for commercial use.

The objectives and rationale of the vapor intrusion assessment are described in the Data Quality Objectives section, below.

3.0 DATA QUALITY OBJECTIVES

The data quality objectives ("DQOs") are designed to guide the collection of additional data needed to evaluate the potential for human health risks in indoor air from residual COCs in soil under Building 1040. Although DQOs are not generally prepared for Water Board-lead investigations, DQOs have been prepared for this project to illustrate the decision making process. The DQOs are presented in Table 1. Since the Trust plans to lease Building 1040 to commercial businesses, the risk to future recreational or commercial building occupants from exposure to residual subsurface chemicals through the vapor intrusion exposure pathway should be evaluated.

As described in Table 1 and shown on Figure 1, a total of six soil gas vapor sample locations are proposed at Building 1040, in locations on the accessible sides of the building. The results of the soil gas sampling event will be used to evaluate potential risk via the vapor intrusion pathway.. The DTSC guidance indicates that if calculated hypothetical health risks for potential future populations at a given sampling location are not significant (e.g. equal to or less than a cumulative lifetime incremental cancer risk of one-in-one million (10^{-6}) or a total non-carcinogenic hazard index ("HI") is equal to or less than one), indoor air sampling need not be performed. As the building is unoccupied and will undergo major renovation prior to use, indoor air sampling is not appropriate. If the risks associated with concentrations in soil gas exceed the ESLs, then the Trust will evaluate potential options for follow-up and assessment prior to building occupancy. These options could include the following, and others: (1) performance of indoor air sampling after the building has been cleaned up, (2) assessment of applicable site-specific goals based on the actual planned land use, or (3) incorporation of mitigation measures into the planned redevelopment.

4.0 FIELD ACTIVITIES

4.1 Pre-Field Activities

The Trust, NPS, and EKI will select soil gas sampling locations in the field; the Water Board, DTSC, and RAB will be invited to the field meeting to provide field input if they choose. EKI will contact Underground Service Alert prior to the initiation of subsurface work, and the utility owners and Trust Utility Department will provide utility clearance prior to drilling. EKI will prepare a site-specific health and safety plan for its workers, and prepare subcontracts with the California-licensed drilling contractor.

4.2 General Field Procedures

4.2.1 General Field Procedures for Collection of Soil Gas Samples

As described in the DQO table (Table 1), EKI will collect soil gas samples from up to 6 locations outside Building 1040, as indicated on Figure 2. Using direct push technology, EKI's soil gas sampling contractor will install temporary soil gas implants in accordance with the joint DTSC and the California Regional Water Quality Control Board – Los Angeles Region ("LARWQCB") *Advisory – Active Soil Gas Investigations*, dated 28 January 2003 (DTSC and LARWQCB, 2003) ("State Advisory"), the procedures outlined in Appendix A, and Standard Operating Procedures ("SOP") SOP 011, SOP 014, and SOP 015 of the Trust QAPP (included as part of Appendix A). Soil gas samples will be collected from as close as reasonably practical to the buildings (approximately 2-4 feet from the walls) and approximately 5 feet below ground surface ("bgs"), at least 1 foot above local groundwater elevation measured in the nearby groundwater monitoring wells. The soil gas samples will be collected in SUMMA canisters and sorbent cartridges provided by an analytical laboratory. The vacuum pressure in each SUMMA canister will be recorded prior to collection of soil gas samples. The analytical laboratory will provide a flow regulation system for sample collection flow for each SUMMA canister. At each location, soil gas sample collection will be stopped when the vacuum pressure in the SUMMA canister is approximately 5 inches Mercury of pressure. Following completion of the collection of the sample in the SUMMA canister, a sorbent cartridge will be attached to the temporary tubing. An air pump with a flow regulator will be used to draw soil gas through the sorbent cartridge until a laboratory-specified amount of soil gas has been drawn through the sorbent cartridge. Temporary tubing to the implants will be removed after the soil gas sample has been collected. The soil gas investigation is anticipated to be completed in one day.

In accordance with the QAPP, sample location identification codes are based on "1040" for Building 1040; "SG" for soil gas; and sequential numbering starting at 101. The media sampled will be marked on the chain of custody form and input into the media field in the Trust database when the data are uploaded. In keeping with the QAPP, a soil gas sample from 5 feet below ground surface will be designated as 1040SG101[5].

The proposed sample identification numbers, depths, and corresponding laboratory analyses are summarized in Table 2. As noted in Table 2, the actual sample number and depth may change based on field conditions encountered.

4.2.2 General Field Procedures for Indoor Cap Assessment

The indoor cap (floor of Building 1040) will be inspected for visible cracks, penetrations, and gaps that could allow COCs to enter the building. Ideally the floor would be cleared and cleaned to facilitate the cap assessment. However, such clearing and cleaning will not be possible. In addition, there are numerous subfloor pipe and cable trenches throughout the building that, though covered with trench plates, have limited inspection access. The trenches contain numerous pipes and cables, and visual inspection of the bottom of the trenches is not anticipated to be possible. While assessment of the indoor cap can be performed, the assessment is anticipated to be limited in scope. Therefore, the floor will be visually inspected, photographed, and a written description of the visible portions of the floor prepared. Areas that cannot be seen will be noted. If penetrations, cracks, or other potential pathways that may allow the migration of COCs into the building are observed, physical improvements will be recommended to address the identified issues. However, due to the extensive trench network, it is not likely that recommendations for cap sealing or physical improvements can be made that would limit the potential for vapor intrusion into indoor air. In addition, depending on the data collected, there may be no indication of vapor intrusion. If large or blatant cracks or penetrations are observed, some options for sealing these penetrations during building renovation could include concrete patches, epoxy sealants, or other means, depending on the conditions encountered.

4.3 Field Quality Control Samples

Field duplicates for soil gas will be collected as part of this investigation. A field duplicate is a sample collected at the same time, and from the same source and depth as the associated primary sample. Field duplicate pairs are collected to assess the consistency or precision of the laboratory's analytical system. The QAPP specifies a frequency of ten percent for field duplicates; therefore, one field duplicate soil gas sample will be collected and submitted to the laboratory for analysis.

4.4 Post-Sample Collection Activities

After completion of the soil gas sampling, a State of California-licensed land surveyor will survey the sampling locations. EKI has assumed that PLS Surveys, Inc. of Oakland, California will perform the surveying under the direction of EKI. The surveyor will

report the survey coordinates in both NAVD88 and PLLW survey datums, as well as identify the control points used to prepare the survey.

Decontamination rinse water from the investigation, if any, will be drummed and sampled for characterization and appropriate disposal. Other anticipated investigation-derived waste includes containers of plastic bags with used personal protective equipment and non-hazardous trash. The non-hazardous trash will be disposed with Trust municipal trash. Disposal of all wastes will be the responsibility of the Trust.

5.0 ANALYTICAL METHODS

The Trust plans to use Air Toxics, Ltd. of Folsom, California, a State-certified analytical laboratory to analyze the soil gas samples and duplicate sample. The soil gas samples and duplicate sample will be analyzed for VOCs by EPA Method TO-15, with SIM (if necessary to achieve detection limits to compare to ESLs) and for PAHs by EPA Method TO-13 on a standard two-week turnaround time. Per the Presidio QAPP, the laboratory will provide data in Level III package with 10 percent of the data being reported in a Level IV package.

The analytical quality control criteria are provided in the QAPP. Analytical data for soil gas samples will be validated by DataVal, Inc. of Novato, California.

6.0 EVALUATION OF POTENTIAL HUMAN HEALTH RISKS

The results of the soil gas sampling events will be compared to ESLs or site-specific goals for commercial/industruial workers.[2]

If ESLs are exceeded, site-specific goals for COCs identified in soil gas may be calculated using the Johnson and Ettinger ("J&E") model for soil gas (SG-ADV.xls) as published by U.S. EPA (2004). Presidio-specific parameters obtained during the Building 937 investigation (EKI, 2006) will be used to perform the calculations. The concentrations detected in soil gas will be compared to the calculated soil gas goals (risk-based target concentrations or RBTCs) as well as ESLs to support the overall assessment of the data obtained during implementation of the work plan.

The chemical-specific risks and HIs due to vapor intrusion measured in soil gas will be calculated for each population by summing the ratio of the maximum soil gas concentration with its respective $RBTC_{SG}$ for carcinogenic and non-carcinogenic COCs. For carcinogens, the summed ratio for each population will be multiplied by 10^{-6} to calculate estimated lifetime incremental cancer risks. For non-carcinogens, the summed ratio for each population will equal the total estimated Hazard Indices.

The equation for calculating the estimated lifetime incremental cancer risk for each population is as follows:

$$Risk_{population} = \sum \frac{C_{SG-i} \times 10^{-6}}{RBTC_{SG-c-i}}$$

where $C_{SG\text{-}i}$ is the maximum concentration of carcinogenic chemical "i" in the soil gas samples and $RBTC_{SG\text{-}c\text{-}i}$ is the risk-based soil gas carcinogenic target concentration for that chemical "i".

Similarly, the total Hazard Index ("HI") for each population is as follows:

$$HI_{population} = \sum \frac{C_{SG-i}}{RBTC_{SG-nc-i}}$$

[4]The future land use for Building 1040 is uncertain at this time, although potential discussions have included uses as office space or a warehouse. Soil gas and indoor air calculations performed previously at the Building 937 Area (EKI, 2006) for recreational and commercial/industrial exposure scenarios resulted in more stringent risk levels for the commercial/industrial exposure scenario. The risk calculations were driven by the commercial/industrial exposure scenario. Therefore, only commercial/industrial exposure calculations are presented in this document.

where C_{SG-i} is the maximum concentration of non-carcinogenic chemical "i" in the soil gas samples and $RBTC_{SG-nc-i}$ is the risk-based soil gas non-cancer target concentration for that chemical "i".

The results of the soil gas sampling event will be used to calculate potential risks, using the equations and methods described above. This information will be used to determine if further assessment of potential vapor intrusion risks is warranted.

7.0 FOLLOW-UP ACTIVITIES, REPORTING, AND SCHEDULE

EKI recognizes that the schedule of this sampling event is important to the Trust for leasing purposes as well as coordination with the Building 1065 CAP Implementation Work Plan. Field activities will commence within three weeks of stakeholder approval of this Work Plan. For planning purposes, EKI anticipates soil gas sampling will be performed in June 2008, assuming stakeholder approval is obtained in May 2008. It is anticipated that the soil gas sampling event can be completed in one day. Upon receipt of the laboratory data, EKI will review the data and calculate potential human health risks. EKI will provide the Trust with a summary of potential health risks within two weeks of the receipt of the laboratory data. The Thornburg redevelopment project team is currently planning to begin subsurface work at the Site in April 2008. The Trust will notify the Thornburg team of the field work schedule as soon as field work schedule is finalized.

After review of the soil gas data, the Trust will schedule a conference call with the stakeholders to discuss the existing data. The discussion of the data may occur at a regularly scheduled Building 1065 CAP Implementation data review session or, depending on the timing of data receipt and the Trust's needs to begin evaluating future options, a separate conference call may be held to discuss the data.

If chemical concentrations in the soil gas samples are less than the applicable ESLs or site-specific goals, then no further action with regard to vapor intrusion activities will be taken. Upon receipt of validated analytical data and discussion with the stakeholders, the results of the sampling and the conclusions will be incorporated into a sampling report that can be included in the Building 1065 CAP Implementation Construction Completion Report.

If chemical concentrations in the soil gas samples are greater than the applicable ESLs or site-specific goals, then the Trust will summarize the data and meet with the stakeholders (NPS, Water Board, RAB, and Trust Real Estate) to assess the options for follow-up assessment. The options will depend on the planned reuse of Building 1040 and could include the following, among others:

- performance of indoor air sampling after the building has been cleaned up for a known future reuse;
- reassessment of applicable site-specific goals based on the final planned land use that will be determined by the Trust and their developer selected for the Thornburg redevelopment project (e.g., a storage warehouse that is occupied only occasionally will have significantly less exposure than standard commercial/industrial use or recreational use); or
- incorporation of mitigation measures into the planned redevelopment (e.g., the reuse of the building could include the installation of positive pressure ventilation or subslab ventilation).

If the chemical concentrations in the soil gas samples are greater than the revised site-specific goals using the final planned land use exposure assumptions, the building's indoor air will be sampled for the constituents that were detected in the soil gas survey once the building has been cleaned up and prepared for reoccupation.

As stated above, the results of the sampling and the conclusions will be incorporated into a sampling report that can be included in the Building 1065 CAP Implementation Construction Completion Report. However, the specific follow-up activities and the associated timing for implementation will depend on the planned reuse and the associated reuse schedule. Additional coordination work between Trust Real Estate and Remediation departments will be identified in the Completion Report. Notifications for reuse and construction at building 1040 will be addressed in the LUCMRR addendum.

8.0 REFERENCES

DTSC, 2004. *Interim Final Guidance for the Evaluation and Mitigation of Subsurface Vapor Intrusion to Indoor Air*. December. Revised Feb. 7, 2005.

DTSC and LARWQCB, 2003. *Advisory – Active Soil Gas Investigations*. 28 January 2003.

Erler & Kalinowski, Inc. ("EKI"), 2006. *Buildings 933 and 937 Vapor Intrusion Assessment and Field Sampling Report, Presidio of San Francisco, California*. October.

EKI, 2002. *Development of Presidio-Wide Cleanup Levels for Soil, Sediment, Groundwater and Surface Water, Presidio of San Francisco, California*. October, as revised in May 2006.

MACTEC Engineering and Consulting, Inc. ("MACTEC"), 2007a. *Corrective Action Implementation Work Plan, Building 1065 Area, Presidio of San Francisco, California*. 10 August.

MACTEC, 2007b. *Final Corrective Action Plan, Building 1065 Area, Presidio of San Francisco, California*. 24 January.

Regional Water Quality Control Board, San Francisco Bay Region, *Site Cleanup Requirements, Presidio of San Francisco, California*, Order R2-2003-0080.

Tetra Tech, 2001. *Presidio-Wide Quality Assurance Project Plan, Sampling and Analysis Plan, Presidio of San Francisco, California*. April.

US EPA, 2002. *OSWER Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils (Subsurface Vapor Intrusion Guidance)*. November.

TABLE 1 - BUILDING 1040 DATA QUALITY OBJECTIVES

Presidio of San Francisco, California

State the Problem	Identify the Decisions	Identify Inputs to the Decisions	Define the Study Boundaries	Develop Decision Rules	Specify Limits on Decision Errors	Optimize the Design
Total petroleum hydrocarbons ("TPH") as diesel and fuel oil have been detected in soil above applicable cleanup levels at the northwestern corner of Building 1040. An indoor air assessment will be conducted to evaluate the potential for vapor intrusion of volatile organic compounds ("VOCs") from the subsurface into indoor air. Inspection of the building slab will also be performed to assess potential for vapor intrusion. Two former above ground storage tanks (1040.1 and 1040.2) in the northwestern corner of the building were used by the Army to store fuel for the boiler operations at Building 1040. The Army removed the tanks and performed remedial actions; however, impacted soil near the building foundation could not be removed without compromising the building's structural integrity. The Trust plans to lease Building 1040 to tenants for recreational/commercial use. This sampling program is proposed to evaluate whether residual subsurface chemicals pose a significant risk to future recreational or commercial building occupants through the vapor intrusion exposure pathway. Access to subslab vapor is limited by slab thickness and access; therefore, perimeter soil gas sampling is proposed.	1. Are residual petroleum hydrocarbons and VOCs from previous Army impacts present in the soil gas at Building 1040? 2. If residual petroleum hydrocarbons and VOCs are present in the soil gas, are they present at concentrations that are potentially a significant risk (i.e., greater than 10^{-6} lifetime incremental cancer risk or a cumulative noncancer hazard index ("HI") >1)? 2. Does the existing slab and foundation of Building 1040 provide a sufficient cap for limiting potential exposure to residual petroleum hydrocarbons in the subsurface? Are improvements or modifications necessary to enhance the cap?	1. Results of previous chemical analysis of soil and groundwater samples. 2. Results of chemical analysis from soil gas investigation. 3. DTSC Guidance. 4. Visual assessment of the building slab.	The study boundaries for the soil gas investigation are near the perimeter of Building 1040 as internal subslab access is not available. The indoor cap assessment will be conducted within Building 1040.	1. If chemical concentrations are detected in soil gas samples, the potential risks associated with those chemicals due to vapor intrusion will be assessed. If potential risks are not significant, then no further vapor intrusion assessment is warranted. 2. If the risk associated with chemicals in soil gas due to vapor intrusion is less than or equal 10^{-6} for carcinogens or a HI of 1 for non-carcinogens, then no indoor cap modifications will be proposed. 3. If chemical concentrations in soil gas pose a risk greater than 10^{-6} for carcinogens or greater than an HI of 1, the Trust can present potential options in the completion report for follow-up assessment during development activities.	1. Field, analytical, and data validation procedures will follow the QAPP (Tetra Tech, 2001), as modified to follow DTSC Guidance. Duplicate soil gas samples will also be collected per the QAPP.	The portion of Building 1040 acting as a cap is approximately 50' x 35', with no interior walls. 1. Six soil gas samples will be collected from locations outside Building 1040, as shown on Figure 2. Subslab vapor samples cannot be collected due to slab thickness and access constraints. Samples will be collected from the soil gas from areas near the known impacted soil and around the perimeter of the building. Probes will be advanced to collect soil gas samples at approximately five feet below ground surface. Soil gas samples will be collected in SUMMA canisters and analyzed by a fixed laboratory for VOCs using US EPA Method TO-15 with SIM, if necessary, and collected on sorbent cartridges and analyzed for PAHs using US EPA Method TO-13a. Duplicates of 10% of the soil gas samples will also be analyzed by US EPA Methods TO-13a and TO-15. Soil gas data will be validated by a data validation firm.

Abbreviations:

DTSC	Department of Toxic Substances Control, California Environmental Protection Agency
DTSC Guidance	*Interim Final, Guidance for the Evaluation and Mitigation of Subsurface Vapor Intrusion to Indoor Air*, DTSC, dated 7 February 2005.
HI	Hazard Index
PAHs	polycyclic aromatic hydrocarbons
QAPP	*Presidio-Wide Quality Assurance Project Plan, Sampling and Analysis Plan*, Tetra Tech EM Inc., dated April 2001.
TPH	total petroleum hydrocarbons
VOCs	volatile organic compounds

TABLE 2
SAMPLE LABORATORY ANALYSIS MATRIX

Presidio of San Francisco, California

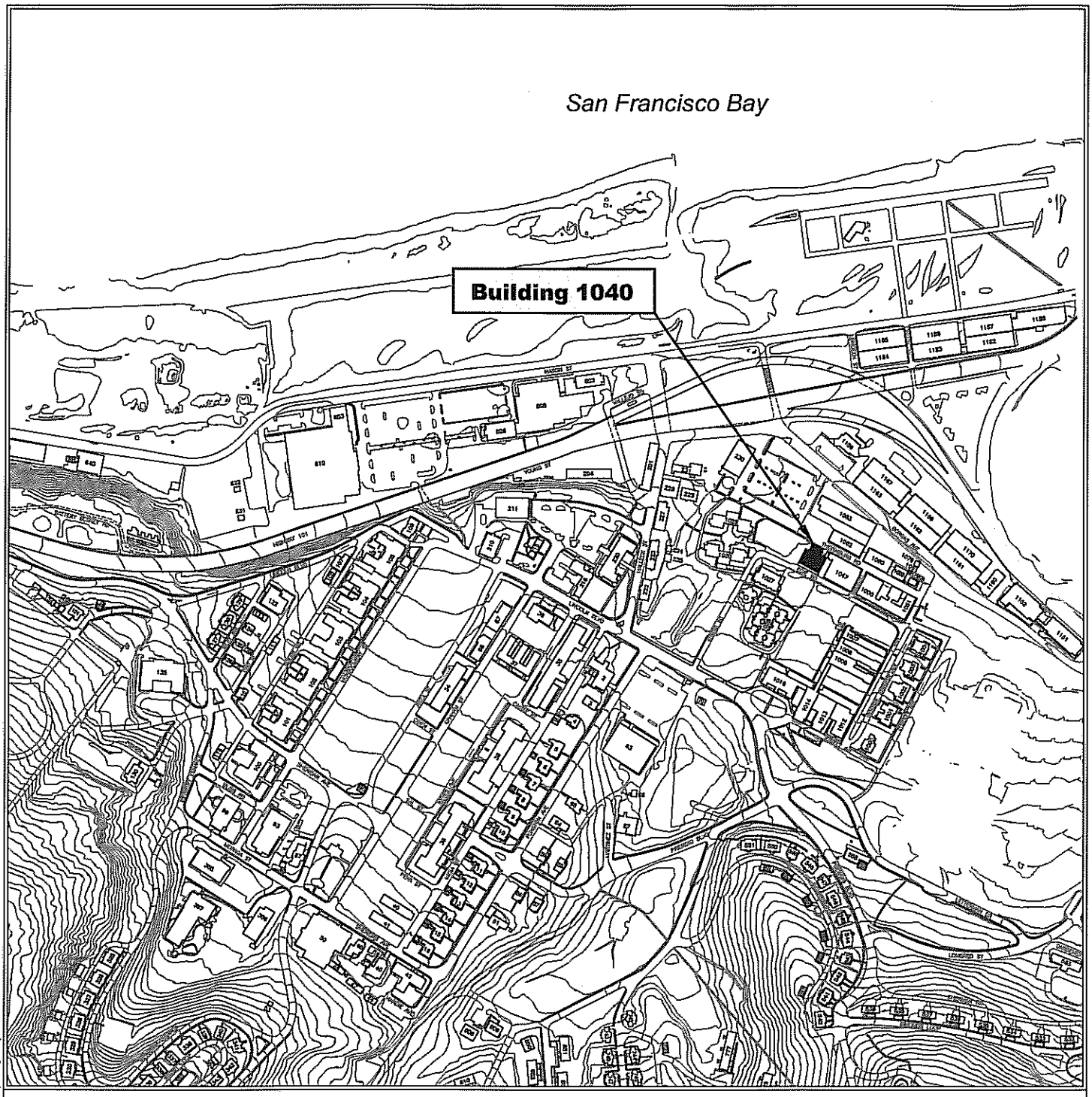
Sample ID	Sample Depth (ft bgs) (note 1)	Matrix	Laboratory Analyses	
			VOCs (US EPA TO-15)	PAHs (US EPA TO-13a)
Soil Gas Samples				
1040SG101(5)	5	soil gas	*	*
1040SG102(5)	5	soil gas	*	*
1040SG103(5)	5	soil gas	*	*
1040SG104(5)	5	soil gas	*	*
1040SG105(5)	5	soil gas	*	*
1040SG106(5)	5	soil gas	*	*

Abbreviations:

ft bgs – feet below ground surface
ID – identification
PAHs – polycyclic aromatic hydrocarbons
QAPP – Quality Assurance Project Plan
US EPA – United States Environmental Protection Agency
VOCs – volatile organic compounds

Notes:

(1) Proposed soil gas sample depths may be modified based on field conditions.
(2) Per QAPP guidance, one duplicate will be collected for every ten samples on each day of the field work. Duplicate samples will be noted with "DUP" in the Sample ID. A duplicate soil gas sample will be collected at location 1040SG101(5) and analyzed in a fixed laboratory by TO-15 and TO-13a.



Reference: Basemap source: Presidio Trust, 2006.

Note:

1. All locations are approximate.

N

0 600 1200

(Approximate Scale in Feet)

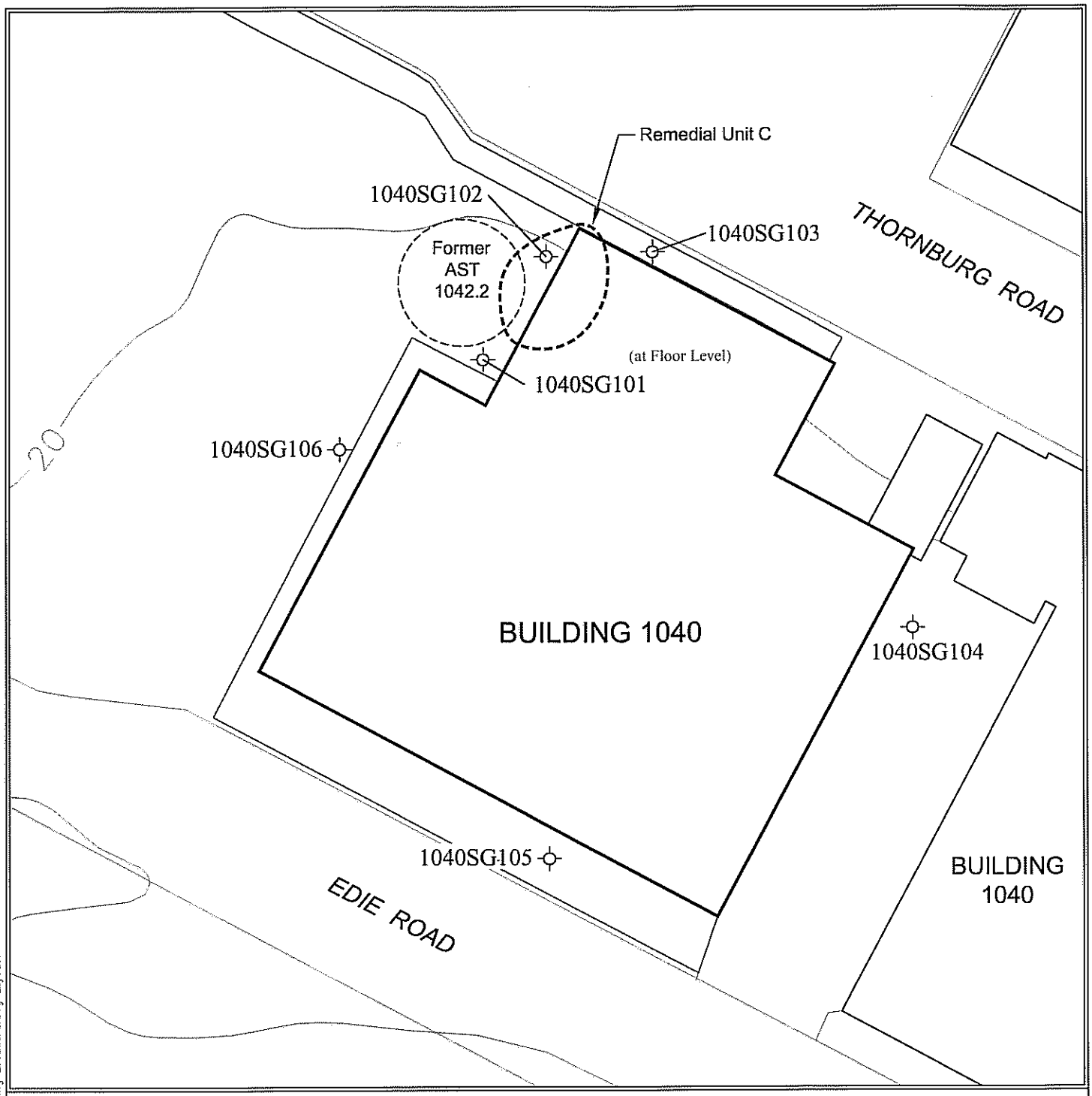
Erler & Kalinowski, Inc.

Site Location Map

Building 1040
The Presidio Trust
San Francisco, CA
March 2008
EKI A70004.19

Figure 1

20080314.10380167 C:\A70004.19\Mar08\Figure 01 - Site Location Map.dwg Layout1



Reference: Basemap source: Presidio Trust, 2006.

Note:

Proposed Soil Gas Sampling Location

Note:

1. All locations are approximate.

Erler & Kalinowski, Inc.

Proposed Sampling Locations

N

0 25 50

(Approximate Scale in Feet)

Building 1040
The Presidio Trust
San Francisco, CA
March 2008
EKI A70004.19

Figure 2

20080314 10332685 C:\A70004.19\Mar08\Figure 02 - Proposed Sampling Locations.dwg Layout1

Appendix A

Field Methods and Procedures For Soil Gas Sampling and Air Sampling

And

Selected Standard Operating Procedures

from

Presidio-Wide Quality Assurance Project Plan, Sampling and Analysis Plan. **April 2001**

APPENDIX A

FIELD METHODS AND PROCEDURES FOR SOIL GAS SAMPLING AND INDOOR AND AMBIENT AIR SAMPLING

Building 1040, Presidio of San Francisco, California

A-1 Soil Gas Sampling

Soil gas sampling will be conducted generally in accordance with Trust Standard Operating Procedure No. 011, Soil Gas Sampling Methods, found in the Trust QAPP, and the joint Department of Toxic Substances Control ("DTSC") and Regional Water Quality Control Board, Los Angeles Region ("LARWQCB") guidance, entitled *Advisory—Active Soil Gas Investigations* and dated 28 January 2003. Samples will be collected in a 6-liter SUMMA canister and on a sorbent cartridge provided by the analytical laboratory. To collect soil gas samples, a boring will be advanced by direct push technology to the desired sampling depth, 5 feet below ground surface ("bgs"). Once the desired depth is achieved, a stainless steel implant connected to polyethylene tubing (1/4-or-1/8 inch diameter) will be placed in the bottom of the hole and covered with 6-12 inches of sand. Above the sand, the hole will be filled with hydrated bentonite to create a seal. The sample tubing will protrude through the bentonite to allow collection of the soil gas sample from the implant. Subsurface conditions will be allowed to equilibrate for 30 minutes before purging and sampling in accordance with current state guidelines. Because a fixed laboratory will be used, a purge volume test will not conducted prior to collection of soil gas samples. As part of the Building 937 soil gas investigation in July 2006, TEG of Rancho Cordova, California collected soil gas samples and analyzed the samples using EPA Method 8260 in a mobile laboratory. TEG performed a purge volume test by analyzing samples collected after 1, 3, and 7 purge volumes were removed from the soil gas implant. TEG found that 7 purge volumes produced the highest concentrations of VOCs. For this investigation, 7 purge volumes will be purged into a "purge" SUMMA canister at each location prior to the collection of the soil gas sample that will be analyzed by Calscience.

The volume of gas to be purged will be calculated for each sample location based on the following variables:

- Length of filter pack in inches ("FP");
- Borehole diameter in inches ("BH");
- Length of tubing used in feet ("TL");
- Inner diameter of tubing in inches ("TD")
- Flow rate of SUMMA canister in milliliters per minute ("FR").

The formula to determine one purge volume is:

$$PV = CF*[FP*\pi*(0.5*BH)^2 + 12*TL*(0.5*TD)^2]$$

Where PV is one purge volume (in liters), and CF is a unitless conversion factor of 0.016387 to convert cubic inches into liters.

Since seven purge volumes will be purged prior to sample collection, the formula to determine the purge time is:

Time (minutes) = 7*PV / (1000*FR)

The joint LARWQCB and DTSC guidance recommends a purging and sampling rate for filling of SUMMA canisters of between 100 and 200 milliliters/minute. The analytical laboratory will set all flow regulators to be used for soil gas purging and collection of soil gas samples to fill at the same rate and at a value in the range recommended. The analytical laboratory will communicate the rate to EKI when the SUMMA canisters are shipped.

The purge SUMMA canister and sample collection SUMMA canister will be connected such that no tubing or piping will be removed or reconnected between the purging and sample collection. After the appropriate volume of gas has been purged, the valve to the purge SUMMA canister will be closed and the valve to the sample collection SUMMA canister opened. The valve to the sample collection SUMMA canister will be closed when there is approximately 5 inches Mercury of vacuum pressure in the canister. The final vacuum pressure will be recorded. If a SUMMA canister arrives at Air Toxics with no remaining vacuum pressure, that SUMMA may not be analyzed due to the possibility that a vacuum leak occurred following completion of sampling at that location.

During sampling leak detection compounds, such as 1,1-difluoroethane or tetrafluoroethane, which are found in "dust-off" sprays, will be regularly discharged around all tubing joints where leakage of ambient air into the system could potentially occur. These compounds were selected as the leak detection compounds because they are non-toxic gases that are easily identifiable during analysis and do not occur at contaminated sites. Therefore, it does not interfere with the quantitative analysis of VOCs.

After sampling into the SUMMA has been completed, the purge and sample collection SUMMAs will be removed from the tubing. The sorbent cartridge used for collection of the soil gas sample to be analyzed by US EPA Method TO-13a will be attached to the tubing. An air pump with a flow regulator will be attached to the sorbent cartridge using clean tubing. Following connection of the sorbent cartridge to the tubing and the air pump, 20 liters of soil gas will be pulled from the boring through the sample cartridge at a rate between 100 and 200 mililiters/minute. Exposing the sorbent cartridge to 20 liters of soil gas will insure that the detection limit for naphthalene is lower than the applicable ESL for shallow soil gas. After 20 liters of soil gas has been pulled through the sorbent cartridge, the pump will be shut off and the sorbent cartridge packed according to laboratory instructions.

A field duplicate soil gas sample for analysis at a fixed laboratory will be collected from sample location 1040SG101in the manner described above.

At the discretion of the Trust, sampling tubing may be left in place for possible resampling at a later date. When sampling has been completed, the tubing will be removed and the bentonite will seal the boring. Borings within concrete or asphalt will be repaved upon completion of the work.

A-3.0 Disposal of Investigation-Derived Wastes

Wastes generated during the investigations at Building 1040 will include gloves and other personal protective equipment. Since the soil gas samples will be collected by direct push technology, no soil residuals are anticipated. Any wastes generated during the sampling event will only be exposed to limited vapor concentrations which are not likely to contain chemicals of concern. Therefore, no hazardous waste residuals are expected from the sampling event.

SOP APPROVAL FORM

THE PRESIDIO TRUST

ENVIRONMENTAL STANDARD OPERATING PROCEDURE

SOIL GAS SAMPLING METHODS

SOP NO. 011

REVISION NO. 00

Last Reviewed: December 2000

Quality Assurance Approved

12 JAN 01

Date

1.0 BACKGROUND

Soil gas samples are collected in environmental investigations to assess the vapor phase of contaminants in the vadose zone (soil gas) or other gaseous constituents of interest. Soil gas samples can be collected using several methods. This standard operating procedure (SOP) presents sample collection procedures for collecting soil gas samples in Tedlar® bags, glass sampling bulbs, and stainless-steel canisters. Tedlar® bags and glass sampling bulbs are best suited for on-site or near-site chemical analysis, whereas steel canisters are best suited for shipping samples to a full service laboratory.

1.1 PURPOSE

The purpose of this SOP is to provide guidance for the use of Tedlar® bags, glass sampling bulbs, and stainless-steel canisters for soil gas sample collection. Soil gas samples collected by these methods may be analyzed for volatile organic compounds (such as trichloroethene, benzene, and toluene) and for inorganic parameters (such as nitrogen, oxygen, and carbon dioxide).

1.2 SCOPE

This SOP applies to all personnel collecting soil gas samples in Tedlar® bags, glass sampling bulbs, or stainless-steel canisters. The site-specific work and sampling plans should be followed during soil gas sampling activities.

1.3 DEFINITIONS

Soil Gas: The gases or atmosphere filling the void spaces in soils and unconsolidated sediments. These gases may all be of natural origin, but manmade contaminants or by-products may be present in detectable quantities.

Tedlar® Bag: Inflatable bag manufactured from proprietary non-reactive synthetic material impermeable to gases.

1.4 REFERENCES

American Society for Testing Materials (ASTM). 1993. "Standard Guide for Soil Gas Monitoring in the Vadose Zone." *Environmental Standards on Environmental Sampling*. Second Edition. 1997. ASTM D 5314–92. January.

When using steel canisters to collect soil gas, the following items are needed:

- A supply of clean, evacuated stainless-steel canisters (SUMMA® canisters) with a pressure gauge to verify internal pressure
- A vacuum pump (SKC universal flow pump or equivalent) to allow purging of the sample point prior to collection of soil gas samples
- Tygon® tubing or equivalent of appropriate size for connecting the sampling port to pump (during gas point purging) and the sampling port to stainless steel canister (during sample collection)
- Y-branched tubing (plastic, Teflon®-lined if available) for duplicate collection

2.0 PROCEDURES

This section describes selection of soil gas sampling locations and general preparation of the sampling system to be used. This section also provides detailed procedures for collecting samples using Tedlar® bags, glass bulbs, and stainless-steel canisters. Finally, this section discusses additional considerations that affect soil gas sampling (including duplicate and equipment blank sample collection, decontamination, and sample transfer) and summarizes the advantages and disadvantages of each sampling method.

2.1 SAMPLING LOCATION SELECTION

Sampling locations should be selected and prepared for sampling as described in a project-specific field sampling plan (FSP). Soil gas samples may be collected from depths as shallow as 3 feet or as great as 50 feet, depending on the objectives of the project, the site soil conditions, and the specific equipment used to penetrate to depth.

2.2 SAMPLING SYSTEM PREPARATION

Typical sample probe assemblies may consist of three types: (1) a hand-driven soil gas probe 4 feet in length, (2) a drill rig-driven soil gas probe 2 feet in length, and (3) a hydraulic-driven soil gas probe 3 feet in length. The probes may be assembled in series to reach the desired sampling depth. The probes will be driven to or emplaced at the desired sample collection depth, and then fitted with the Tygon® sampling line.

9. Turn off the pump.

10. Label the Tedlar® bag and its corresponding field datasheet (see Attachment A) with the sample number. An alternative documentation procedure is to enter the requisite information in the field logbook. Fill out the rest of the field datasheet.

2.4 SAMPLE COLLECTION USING GLASS BULBS

Soil gas also can be collected for chemical analysis in a glass bulb. When this sampling method is used, the glass bulb must be connected to the sampling system and purged of ambient air along with the sampling line before the sample is collected. The system is purged and the sample is collected using the following procedure:

1. Connect one end of the glass bulb to the sample line and the other end of the glass bulb to the vacuum pump using Tygon® tubing, and then open both stopcocks on the bulb.

2. Turn on the vacuum pump and purge the sampling system as discussed in Section 2.2.

3. Turn off the vacuum pump.

4. Observe the inline pressure gauge to determine when the vacuum in the bulb has been filled with soil gas. This may require several minutes, particularly in soils with low porosity and permeability. If the vacuum in the bulb has not dropped after 4 minutes of sampling, raise the soil gas probe in 0.5-foot increments in an attempt to find a more permeable zone. If the soil gas probe is moved, guard against leakage of ambient air into the system and repurge if necessary.

5. Once the vacuum in the gas sampling bulb has been filled, close off the upstream stopcock on the bulb, then the downstream stopcock and disconnect the bulb from the sample line.

6. Label the glass bulb and its corresponding field datasheet (see Attachment A) with the sample number. An alternative documentation procedure is to enter the requisite information in the field logbook. Fill out the rest of the field datasheet.

2.5 SAMPLE COLLECTION USING STAINLESS-STEEL CANISTERS

Soil gas also can be collected for chemical analysis in a stainless-steel, evacuated canister. Often, these canisters are used to collect duplicate samples for off-site analysis from locations that are being sampled for field screening analysis using Tedlar® bags or glass bulbs.

2.7 DECONTAMINATION

Sampling probes should be decontaminated before the first sample is collected and between sampling points. Probes that are grossly contaminated should be decontaminated using a high-pressure steam cleaner. Probes that are not grossly contaminated can be decontaminated by brushing off loose soil particles, then heating the probes until they are warm to the touch to drive off any volatile contaminants. Heating times of 7 to 10 minutes are generally sufficient for this purpose. This brushing and heating method greatly reduces the generation of decontamination fluids.

Glass sampling bulbs also must be decontaminated between each use. This may be accomplished by purging heated air through the bulbs using a hand-held hair drier and the vacuum pump. Highly contaminated bulbs may require decontamination using either a methanol or soapy water wash and a deionized water rinse.

If Y-branched tubing or any other sampling equipment is to be reused, it must also be decontaminated between sampling locations.

2.8 SAMPLE TRANSFER

After collection, each sample container will be transported to the designated laboratory for analysis. In many cases, samples will be analyzed on site in a mobile laboratory.

2.9 ADVANTAGES AND DISADVANTAGES OF EACH SAMPLING METHOD

Tedlar® bags are relatively inexpensive to use but can only be used once and then must be disposed of. If the soil formation being sampled has a low porosity and permeability, such as clay or silty clay, it may not be possible to fully inflate the Tedlar® bag with soil gas.

Glass bulbs are more expensive than Tedlar® bags but they can be reused indefinitely, as long as they are not broken. However, bulbs must be decontaminated between each use, and periodic equipment blanks must be analyzed to verify that the decontamination procedures used are effective.

Stainless-steel canisters are very expensive and, therefore, are not cost-effective when conducting on-site analysis. The advantage of this type of sampler is that confirmation samples may be collected and shipped off-site for analysis with excellent assurance of sample integrity.

ATTACHMENT A
FIELD DATASHEET FOR SOIL GAS SAMPLING METHODS

FIELD DATASHEET FOR SOIL GAS SAMPLING METHODS

Date: _____ Project/Site Name: _____

Time: _____ MWO No.: _____

Sample Container: _____ Tedlar® Bag: _____ Glass Bulb: _____ SUMMA® Canister: _____

Sampling Location and Depth: _____

Description of Location: _____

Sample Location Purged: Yes _____ FID or PID (circle one) Reading: _____

Sample Relinquished By: _____ Date/Time: _____

Sample Received By: _____ Date/Time: _____

Attach field copy of sample label or write in sample number.

Notes:

SOP APPROVAL FORM

THE PRESIDIO TRUST

ENVIRONMENTAL STANDARD OPERATING PROCEDURE

GENERAL EQUIPMENT DECONTAMINATION

SOP NO. 014

REVISION NO. 00

Last Reviewed: December 2000

Quality Assurance Approved

12 Jan 01

Date

1.0 BACKGROUND

All nondisposable field equipment must be decontaminated before and after each use at each sampling location to obtain representative samples and to reduce the possibility of cross-contamination.

1.1 PURPOSE

This standard operating procedure (SOP) establishes the requirements and procedures for decontaminating equipment in the field.

1.2 SCOPE

This SOP applies to decontaminating general nondisposable field equipment. To prevent contamination of samples, all sampling equipment must be thoroughly cleaned prior to each use.

1.3 DEFINITIONS

Nonphosphate soap: Alconox® and Liquinox® are common laboratory grade products

1.4 REFERENCES

U.S. Environmental Protection Agency (EPA). 1992. "RCRA Groundwater Monitoring: Draft Technical Guidance." Office of Solid Waste and Emergency Response. Washington, DC. EPA/530-R-93-001. November.

EPA. 1994. "Sampling Equipment Decontamination." Environmental Response Team SOP No. 2006. Revision No. 0.0. August 11. (On-Line Address: http://www.ert.org/media_resrcs/media_resrcs.asp.)

1.5 REQUIREMENTS AND RESOURCES

The equipment required to conduct decontamination is as follows:

- Scrub brushes
- Large wash tubs or buckets
- Squirt bottles
- Nonphosphate soap
- Tap water

2.2 DRILLING AND MONITORING WELL INSTALLATION EQUIPMENT DECONTAMINATION

All drilling equipment should be decontaminated before drilling operations begin, between borings, and at completion of the project. The locations for decontamination activities will be designated by the Trust project manager.

Monitoring well casing, screens, and fittings are assumed to be delivered to the site in a clean condition. However, they should be steam cleaned on-site prior to placement downhole. The drilling subcontractor will typically furnish the steam cleaner and water.

After cleaning the drilling equipment, field personnel should place the drilling equipment, well casing and screens, and any other equipment that will go into the hole on clean polyethylene sheeting. The drilling auger, bits, drill pipe, temporary casing, surface casing, and other equipment should be decontaminated by the drilling subcontractor by hosing down with a steam cleaner until thoroughly clean. Drill bits and tools that still exhibit particles of soil after the first washing should be scrubbed with a wire brush and then rinsed again with a high-pressure steam rinse.

All wastewater from decontamination procedures should be containerized.

2.3 BOREHOLE SOIL SAMPLING EQUIPMENT DECONTAMINATION

The soil sampling equipment should be decontaminated after each sample as follows:

1. Prior to sampling, scrub the split-barrel sampler and sampling tools in a bucket, containing Liquinox® or Alconox® solution, using a stiff, long bristle brush.
2. Steam clean the sampling equipment over the rinsate tub and allow to air dry or rinse with deionized (distilled) water.
3. Place cleaned equipment in a clean area on plastic sheeting and wrap with aluminum foil.
4. Containerize all water and rinsate.
5. Decontaminate all pipe placed down the hole as described for drilling equipment.

SOP APPROVAL FORM

THE PRESIDIO TRUST

ENVIRONMENTAL STANDARD OPERATING PROCEDURE

PACKAGING AND SHIPPING SAMPLES

SOP NO. 015

REVISION NO. 00

Last Reviewed: December 2000

Quality Assurance Approved

12 JAN 01

Date

1.0 BACKGROUND

In any sampling program, the integrity of a sample must be ensured from its point of collection to its final disposition. Procedures for classifying, packaging, and shipping samples are described below. Steps in the procedures should be followed to ensure sample integrity and to protect the welfare of persons involved in shipping and receiving samples. When hazardous substances and dangerous goods are sent by common carrier, their packaging, labeling, and shipping are regulated by the U.S. Department of Transportation (DOT) Hazardous Materials Regulations (HMR) (*Code of Federal Regulations*, Title 49 [49 CFR] Parts 106 through 180) and the International Air Transportation Association (IATA) Dangerous Goods Regulations (DGR).

1.1 PURPOSE

This standard operating procedure (SOP) establishes the requirements and procedures for packaging and shipping samples. It has been prepared in accordance with the U.S. Environmental Protection Agency (EPA) "Sampler's Guide to the Contract Laboratory Program (CLP)," the DGR, and the HMR. Sample packaging and shipping procedures described in this SOP should be followed for all sample packaging and shipping. Deviations from the procedures in this SOP must be documented in a field logbook. This SOP assumes that samples are already collected in the appropriate sample jars and that the sample jars are labeled and tagged appropriately.

1.2 SCOPE

This SOP applies to sample classification, packaging, and shipping.

1.3 DEFINITIONS

Chain of Custody: Document indicating custody of the samples at all times between sampling and analysis.

Custody Seal: A custody seal is a tape-like seal. Placement of the custody seal is part of the chain-of-custody process and is used to prevent tampering with samples after they have been packaged for shipping.

1.4 REFERENCES

U.S. Department of Transportation, Transport Canada, and the Secretariat of Communications and Transportation of Mexico (DOT and others). 1996. *1996 North American Emergency Response Guidebook.*

International Air Transport Association (IATA). 1997. *Guidelines for Instructors of Dangerous Courses.*

IATA. 1999. *Dangerous Goods Regulations.* 40th Edition.

U.S. Environmental Protection Agency. 1994. "Sampler's Guide to the Contract Laboratory Program." Office of Solid Waste and Emergency Response. Washington, DC. EPA/540/R-96/032. On-Line Address: http://www.epa.gov/oerrpage/superfund/programs/clp/guidance.htm - sample

1.5 REQUIREMENTS AND RESOURCES

The procedures for packaging and shipping **nonhazardous** samples require the following:

- Coolers
- Ice
- Vermiculite, bubble wrap, or similar cushioning material
- Chain-of-custody forms and seals
- Airbills
- Resealable plastic bags for sample jars and ice
- Tape (strapping and clear)

The procedures for packaging and shipping **hazardous** samples require the following:

- Ice
- Vermiculite or other noncombustible, absorbent packing material
- Chain-of-custody forms and seals
- Appropriate dangerous goods airbills and emergency response information to attach to the airbill
- Resealable plastic bags for sample jars and ice

Division 1.6 – Extremely insensitive articles, which do not have a mass explosion hazard

Class 2 – Gases

Division 2.1 – Flammable gas
Division 2.2 – Nonflammable, nontoxic gas
Division 2.3 – Toxic gas

Class 3 – Flammable Liquids

Class 4 – Flammable Solids; Substances Liable to Spontaneous Combustion; Substances, when in Contact with Water, Emit Flammable Gases

Division 4.1 – Flammable solids
Division 4.2 – Substances liable to spontaneous combustion
Division 4.3 – Substances, when in contact with water, emit flammable gases

Class 5 – Oxidizing Substances and Organic Peroxide

Division 5.1 – Oxidizers
Division 5.2 – Organic peroxides

Class 6 – Toxic and Infectious Substances

Division 6.1 – Toxic substances
Division 6.2 – Infectious substances

Class 7 – Radioactive Material

Class 8 – Corrosives

Class 9 – Miscellaneous Dangerous Goods

The criteria for each of the first eight classes are very specific and are outlined in Section 3 of the DGR and 49 CFR 173 of the HMR. Some classes and divisions are further divided into packing groups based on their level of danger. Packing group I indicates a great danger, packing group II indicates a medium danger, and packing group III indicates a minor danger. Class 2, gases, includes any compressed gas being shipped and any noncompressed gas that is either flammable or toxic. A compressed gas is defined as having a pressure over 40 pounds per square inch (psi) absolute (25 psi gauge). Most air samples and empty cylinders that did not contain a flammable or toxic gas are exempt from the regulations. An empty hydrogen cylinder, as in a flame ionization detector (FID), is considered a dangerous good unless it is properly purged with nitrogen in accordance with the HMR. A landfill gas sample is usually considered a

1. Place the sample in a resealable plastic bag.

2. Place the bagged sample in a cooler and pack it to prevent breakage.

3. Prevent breakage of bottles during shipment by either wrapping the sample container in bubble wrap, or lining the cooler with a noncombustible material such as vermiculite. Vermiculite is especially recommended because it will absorb any free liquids inside the cooler. It is recommended that the cooler be lined with a large plastic garbage bag before samples, ice, and absorbent packing material are placed in the cooler.

4. Add a sufficient quantity of ice to the cooler to cool samples to 4 °C. Ice should be double bagged in resealable plastic bags to prevent the melted ice from leaking out. As an option, a temperature blank (a sample bottle filled with distilled water) can be included with the cooler.

5. Seal the completed chain-of-custody forms in a plastic bag and tape the plastic bag to the inside of the cooler lid.

6. Tape any instructions for returning the cooler to the inside of the lid.

7. Close the lid of the cooler and tape it shut by wrapping strapping tape around both ends and hinges of the cooler at least once. Tape shut any drain plugs on the cooler.

8. Place two signed custody seals on the cooler, ensuring that each one covers the cooler lid and side of the cooler. Place clear plastic tape over the custody seals.

9. Place address labels on the outside of the cooler, if samples are to be shipped by a commercial carrier.

2.2 PACKAGING HAZARDOUS SAMPLES

Packaging of hazardous samples should only be performed by individuals with DOT shipping training. The procedures for packaging hazardous samples are summarized below. Note that according to the DGR, all spellings must be exactly as they appear in the List of Dangerous Goods, and only approved abbreviations are acceptable. The corresponding HMR regulations are provided in parentheses following any DGR references. The HMR must be followed only if shipping hazardous samples by ground transport.

7. Label and mark each package appropriately. All irrelevant markings and labels need to be removed or obliterated. All outer packaging must be marked with proper shipping name, UN identification number, and name and address of the shipper and the recipient. For carbon dioxide, solid (dry ice), the net weight of the dry ice within the package needs to be marked on the outer package. For limited quantity shipments, the words "limited quantity" or "LTD. QTY." must be marked on the outer package. Affix the appropriate hazard label to the outer package. If the material being shipped contains a subsidiary hazard, then a subsidiary hazard label must also be affixed to the outer package. The subsidiary hazard label is identical to the primary hazard label except that the class or division number is not present. It is acceptable to obliterate the class or division marking on a primary hazard label and use it as the subsidiary hazard label. If using cargo aircraft only packing instructions, then the "Cargo Aircraft Only" label must be used. Package orientation labels (up arrows) must be placed on opposite sides of the outer package. Figure 1 depicts a properly marked and labeled package.

8. If using an overpack (see definition), mark and label the overpack and each outer packaging within the overpack as described in step 7. In addition, the statement "INNER PACKAGES COMPLY WITH PRESCRIBED SPECIFICATIONS" must be marked on the overpack.

9. Attach custody seals, and fill out the appropriate shipping papers as described in Section 2.4.

2.4 SHIPPING PAPERS FOR HAZARDOUS SAMPLES

A "Shippers Declaration for Dangerous Goods" and "Air Waybill" must be completed for each shipment of hazardous samples. Air carriers generally supply a their own Dangerous Goods Airbill to their customers; the airbill typically combines both the declaration and the waybill. An example of a completed Dangerous Goods Airbill is depicted in Figure 2. A shipper's declaration must contain the following:

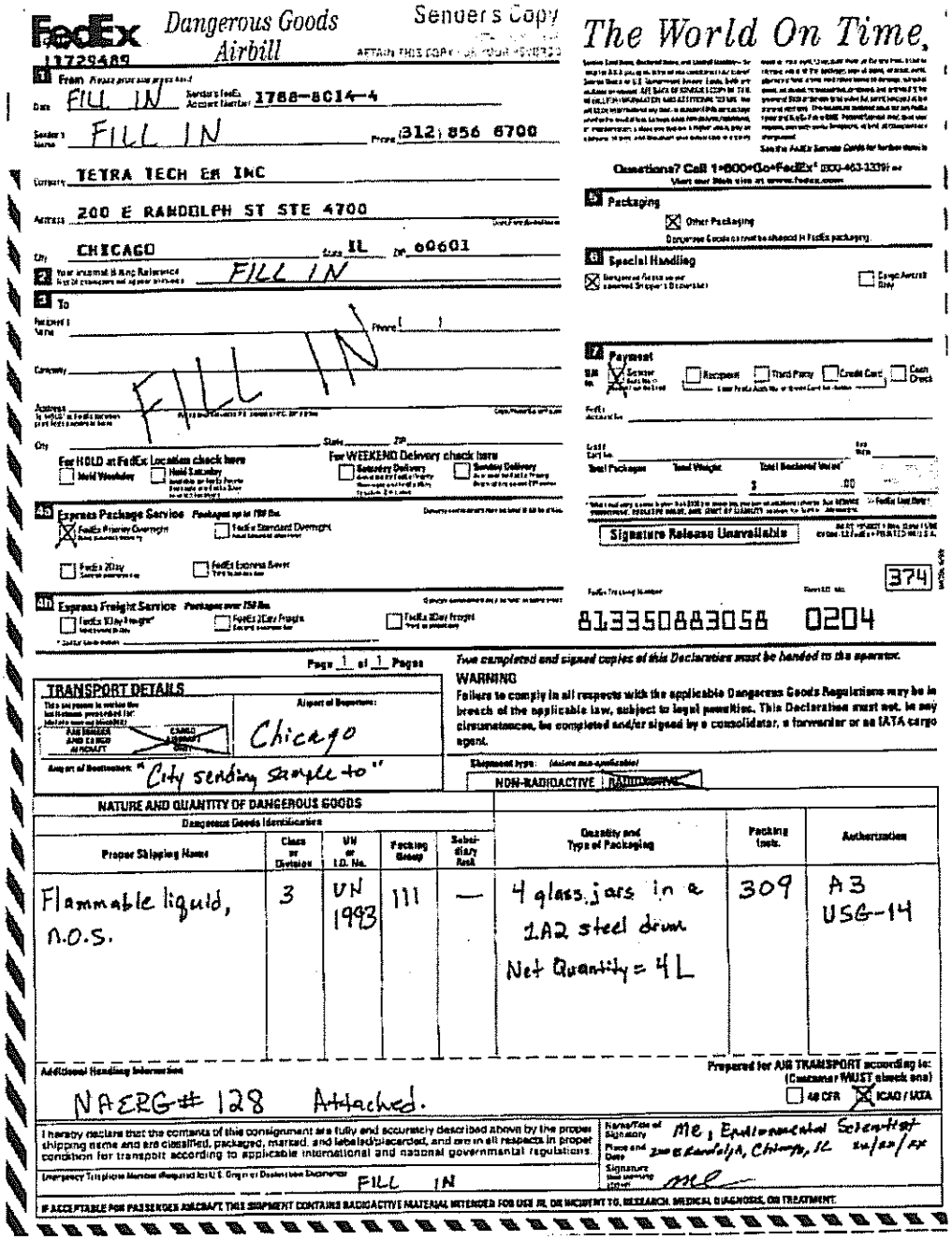
- Name and address of shipper and recipient
- Air waybill number (not applicable to the HMR)
- Page ___ of ___
- Deletion of either "Passenger and Cargo Aircraft" or "Cargo Aircraft Only," whichever does not apply
- Airport or city of departure
- Airport or city of destination
- Deletion of either "Non-Radioactive" or "Radioactive," which ever does not apply

- Improper, misspelled, or missing information on the shipper's declaration. The carrier will most likely notice this as well and return the package to the shipper.

Contact the air carrier with questions about dangerous goods shipments and ask for a dangerous goods expert.

FIGURE 2

EXAMPLE OF A DANGEROUS GOODS AIRBILL



FedEx Dangerous Goods Airbill — Sender's Copy — The World On Time.

1 From: FILL IN — Sender's FedEx Account Number: 1788-8014-4 — Phone: (312) 856 6700
Company: TETRA TECH EM INC
Address: 200 E RANDOLPH ST STE 4700
City: CHICAGO — State: IL — ZIP: 60601
2 Your Internal Billing Reference: FILL IN
3 To: FILL IN
For HOLD at FedEx Location check here — For WEEKEND Delivery check here
4a Express Package Service: FedEx Priority Overnight
4b Express Freight Service
5 Packaging: Other Packaging
6 Special Handling
7 Payment: Sender
Total Packages: 1 — Total Weight: — Total Declared Value*: $ .00
Signature Release Unavailable
374
813350883058 0204

Page 1 of 1 Pages

TRANSPORT DETAILS
Airport of Departure: Chicago
Airport of Destination: "City sending sample to"

Two completed and signed copies of this Declaration must be handed to the operator.

WARNING
Failure to comply in all respects with the applicable Dangerous Goods Regulations may be in breach of the applicable law, subject to legal penalties. This Declaration must not, in any circumstances, be completed and/or signed by a consolidator, a forwarder or an IATA cargo agent.

Shipment type: NON-RADIOACTIVE

NATURE AND QUANTITY OF DANGEROUS GOODS

Dangerous Goods Identifications: Proper Shipping Name	Class or Division	UN or I.D. No.	Packing Group	Subsidiary Risk	Quantity and Type of Packaging	Packing Inst.	Authorization
Flammable liquid, n.o.s.	3	UN 1993	III	—	4 glass jars in a 1A2 steel drum Net Quantity = 4L	309	A3 USG-14

Additional Handling Information: NAERG# 128 Attached.

Prepared for AIR TRANSPORT according to: (Customer MUST check one) ☐ 49 CFR ☒ ICAO / IATA

I hereby declare that the contents of this consignment are fully and accurately described above by the proper shipping name and are classified, packaged, marked and labelled/placarded, and are in all respects in proper condition for transport according to applicable international and national governmental regulations.

Name/Title of Signatory: ME, Environmental Scientist — Place and Date: 200 E Randolph, Chicago, IL 5/20/XX — Signature: ME

Emergency Telephone Number (Required for U.S. Origin or Destination Shipments): FILL IN

IF ACCEPTABLE FOR PASSENGER AIRCRAFT, THIS SHIPMENT CONTAINS RADIOACTIVE MATERIAL INTENDED FOR USE IN, OR INCIDENT TO, RESEARCH, MEDICAL DIAGNOSIS, OR TREATMENT.